

Summary of Results and Strategies for Teachers 2008–2009

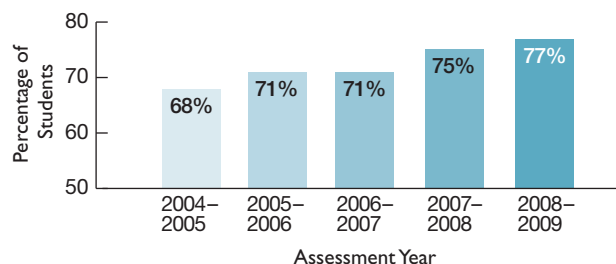
GRADE 9 ASSESSMENT OF MATHEMATICS

ACADEMIC COURSE Comparison of Provincial Results over Time*

	2004–2005	2005–2006	2006–2007	2007–2008	2008–2009
Number of Students	104 100	103 412	103 011	100 823	100 992
Level 4	6%	6%	6%	8%	8%
Level 3	62%	65%	64%	68%	69%
Level 2	19%	17%	18%	16%	15%
Level 1	10%	9%	9%	7%	6%
Below Level 1	1%	1%	1%	1%	<1%
No Data	1%	1%	2%	1%	1%
Exempt[†]	<1%	<1%	N/A [‡]	N/A	N/A
At or Above the Provincial Standard[§]	68%	71%	71%	75%	77%

- There were 100 992 Grade 9 students enrolled in the academic course at the time of the 2008–2009 assessment.
- The Grade 9 assessment is based on *The Ontario Curriculum, Grades 9 and 10: Mathematics* (revised 2005).

PERCENTAGE OF ALL STUDENTS AT OR ABOVE THE PROVINCIAL STANDARD (LEVELS 3 AND 4) OVER TIME



Observations

- There has been an increase of two percentage points (to 77%) since last year in the percentage of students performing at or above the provincial standard in academic mathematics.
- Over the past five years, the percentage of students taking academic mathematics who performed at or above the provincial standard has increased by nine percentage points, from 68% to 77%.

* Because percentages in tables and graphs are rounded, percentages may not add up to 100.

† After 2006–2007, exemptions have not been permitted.

‡ In 2006–2007, students who were coded “exempt” were placed in the “no data” category.

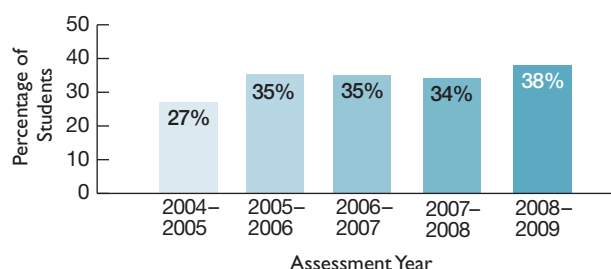
§ These percentages are based on the actual number of students and cannot be calculated simply by adding the rounded percentages of students at Levels 3 and 4.

APPLIED COURSE Comparison of Provincial Results over Time*

	2004–2005	2005–2006 [†]	2006–2007	2007–2008	2008–2009
Number of Students	51 155	50 687	49 056	47 817	48 482
Level 4	<1%	5%	5%	5%	5%
Level 3	26%	31%	30%	29%	33%
Level 2	37%	34%	36%	36%	35%
Level 1	19%	14%	14%	15%	14%
Below Level 1	10%	7%	7%	8%	7%
No Data	6%	8%	9%	7%	6%
Exempt[‡]	1%	2%	N/A [§]	N/A	N/A
At or Above the Provincial Standard^{**}	27%	35%	35%	34%	38%

- There were 48 482 Grade 9 students enrolled in the applied course at the time of the 2008–2009 assessment.
- The Grade 9 assessment is based on *The Ontario Curriculum, Grades 9 and 10: Mathematics* (revised 2005).

PERCENTAGE OF ALL STUDENTS AT OR ABOVE THE PROVINCIAL STANDARD (LEVELS 3 AND 4) OVER TIME



Observations

- There has been an increase of four percentage points (to 38%) since last year in the percentage of students performing at or above the provincial standard in applied mathematics.
- Over the past five years, the percentage of students taking applied mathematics who performed at or above the provincial standard has increased by eleven percentage points, from 27% to 38%.

* Because percentages in tables and graphs are rounded, percentages may not add up to 100.

† Note that significant revisions were made to applied program courses in 2005 as reflected in *The Ontario Curriculum, Grades 9 and 10: Mathematics* (revised 2005).

‡ After 2006–2007, exemptions have not been permitted.

§ In 2006–2007, students who were coded “exempt” were placed in the “no data” category.

** These percentages are based on the actual number of students and cannot be calculated simply by adding the rounded percentages of students at Levels 3 and 4.

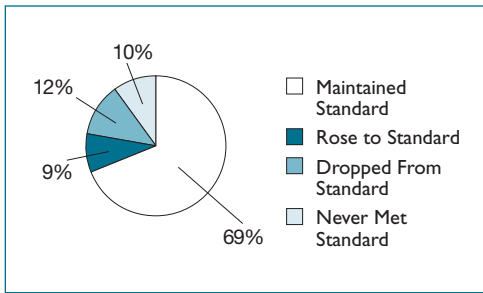
TRACKING THE PROGRESS OF STUDENTS PROVIDES NEW INSIGHTS

EQAO tracked the progress of students who wrote the mathematics component of the junior-division assessment in 2006 and the Grade 9 Assessment of Mathematics in 2009.

Tracking Student Achievement of the Provincial Standard

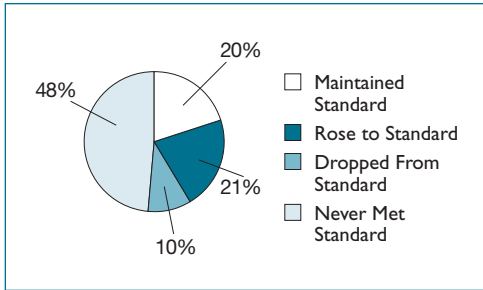
The graphs below show how students performed on the 2009 assessments compared to their assessment results in 2006. The percentages are based on all the students EQAO was able to track from one assessment to the next, including those who provided no work to be scored and those who were exempted in Grade 6.

From Grade 6 Mathematics in 2006 to Grade 9 Academic Mathematics in 2009



- The mathematics results for the 88 583 students in the cohort are as follows:
- 69% (61 116) met the provincial standard in Grade 6 and Grade 9;
 - 9% (8219) did not meet the standard in Grade 6 but met it in Grade 9;
 - 12% (10 388) met the standard in Grade 6 but did not meet it in Grade 9 and
 - 10% (8860) did not meet the standard in Grade 6 or Grade 9.

From Grade 6 Mathematics in 2006 to Grade 9 Applied Mathematics in 2009



- The mathematics results for the 36 529 students in the cohort are as follows:
- 20% (7326) met the provincial standard in Grade 6 and Grade 9;
 - 21% (7809) did not meet the standard in Grade 6 but met it in Grade 9;
 - 10% (3829) met the standard in Grade 6 but did not meet it in Grade 9 and
 - 48% (17 565) did not meet the standard in Grade 6 or Grade 9.

Informing Professional Practice

The following observations and suggested strategies for improvement are meant to assist educators in helping students develop and demonstrate their knowledge and skills in mathematics. The suggestions are based on an analysis of students' performance on the Grade 9 Assessment of Mathematics, Winter and Spring 2009, for both the academic and the applied courses, and on feedback from teachers who scored the assessment.

The released questions can be found in the 2008–2009 Sample Assessment Questions on the EQAO Web site, www.eqao.com.

For more information on the knowledge of content and the cognitive processes that students are required to demonstrate on the assessment, see the Grade 9 Assessment of Mathematics *Framework*, on the EQAO Web site.

For more information on the terms in bold print, refer to the list of resources at the end of this section.

Academic Course	Observations:	Strategies for Improvement:
Number Sense and Algebra	<p>Students were successful on the open-response questions in this strand.</p> <p>Students performed well on the questions requiring the simplification of algebraic expressions but were less successful on those involving exponents.</p> <p>Of particular note was the relative success of students on contextual applications where multiple approaches were possible.</p>	<p>Continue to provide students with opportunities to practise using algebra skills in various contexts with manipulatives (concrete materials) to visualize abstract concepts.</p> <p>Create opportunities for students to gain a conceptual understanding of exponents. Give students occasions to demonstrate this conceptual understanding.</p> <p>Continue to provide students with “rich” problems, and model more than one approach or solution.</p> <p>Regularly require students to provide more than one solution to problems and to make connections between solutions.</p>
Linear Relations	<p>Students generally performed well in this strand. Lack of attention to the requirements of the question and relevant details often reduced success.</p> <p>As in 2008, some students did not consider the scale when working with a linear relation represented on a graph. Many students assumed a one-to-one correspondence between the horizontal and vertical scales.</p>	<p>Employ reading and writing strategies to help students understand and articulate the goals of problems as well as organize the given information.</p> <p>Provide opportunities for students to interpret and compare graphs of the same relation but with different horizontal and vertical scales.</p>
Analytic Geometry (Academic Only)	<p>Students performed moderately well in this strand.</p> <p>When algebraic manipulation to find the slope and/or intercepts was required, students tended to perform better on multiple-choice questions than on open-response questions.</p> <p>On open-response questions, some students struggled to rearrange equations accurately in order to determine the slope and y-intercept.</p> <p>As well, some students confused rise and run when determining slope.</p>	<p>Continue to provide opportunities to reinforce the connections among ordered pairs, points on a graph and the corresponding equation.</p> <p>Concurrently provide instruction for solving equations and for rearranging formulas to enable students to apply the same processes whether the solution is a number or an expression.</p> <p>Provide students with opportunities to investigate the concept of slope and to compare graphs of lines with their slope values. Include graphs whose horizontal and vertical scales have different intervals.</p>

Academic Course	Observations:	Strategies for Improvement:
Measurement and Geometry	<p>Students performed well on questions involving the area or perimeter of two-dimensional shapes that did not involve circles.</p> <p>Common errors in the process of solving the problem involving a circle included misuse of exponents, failure to distinguish between radius and diameter and failure to determine the required fraction of the circle.</p>	<p>Provide students with problems involving complicated composite shapes that have circular parts (e.g., a circle inscribed in a square). Include problems that require them to determine unlabelled dimensions of one shape from the dimensions of the other shapes in the composite shape.</p> <p>Review instructional timelines to ensure that measurement and geometry expectations receive sufficient teaching and learning time.</p>
General Observations on the Mathematics Data	<p>Students struggled with multi-step problems when the solution depended on preliminary calculations. Students chose appropriate mathematical tools (formulas) but were unable to apply them accurately to complete all necessary steps.</p> <p>Students continue to make careless errors when responding to all types of mathematics questions.</p>	<p>Continue to provide students with multi-step problems in various contexts across all strands. Model the problem-solving process for students and provide opportunities for them to demonstrate and discuss problem-solving strategies.</p> <p>Require students to verify their answer by re-stating what the problem requires and considering the reasonableness of their answer.</p> <p>Model working backward to verify a solution.</p> <p>Continue to support students by using Universal Design for Learning.</p>
Gender	<p>Overall, male students performed better than female students on both multiple-choice and open-response questions and across all strands.</p>	<p>Continue to provide opportunities for mixed-gender group work. Rotate roles in the groups to give all members opportunities to experience leadership.</p>
English Language Learners	<p>English language learners performed well on questions requiring procedural knowledge and straight application.</p> <p>Contextualized problems posed the greatest challenge for English language learners, but there was evidence of attempts at reasonable solution processes.</p>	<p>Continue to provide multiple opportunities for English language learners to solve contextualized problems using a variety of tools, such as manipulatives (concrete materials) and graphic organizers. Support students by providing exemplars at various levels of performance.</p>
Students with Special Education Needs (Excluding Gifted)	<p>Overall, students with special education needs demonstrated a pattern of relative strengths and weaknesses similar to that of the general population.</p> <p>Overall, male students in this population performed better than females on both multiple-choice and open-response mathematics questions.</p>	<p>Continue to differentiate instruction for all students but particularly for those with special education needs.</p> <p>Review the <i>Guide for Accommodations</i> and each student's Individual Education Plan to ensure the accommodations that the student receives are permitted for the assessment and are supports he or she uses regularly.</p> <p>Encourage students who are eligible to receive accommodations to take advantage of them.</p>

Applied Course	Observations:	Strategies for Improvement:
Number Sense and Algebra	<p>Students performed better on questions requiring algebra skills without a context than on contextualized problems requiring algebra skills.</p> <p>Generally, students responded to questions involving a ratio between “friendly” numbers with greater success than they did to those involving a less obvious proportional relationship.</p>	<p>Continue to provide students with opportunities to use manipulatives (concrete materials) to visualize algebraic concepts.</p> <p>Ensure students have opportunities to use their algebra skills across all strands. Integrate the teaching of algebra skills where possible through the strands.</p> <p>Continue to teach different approaches to solving for unknowns in proportional relationships.</p>
Linear Relations	<p>Students continue to perform better overall on the questions from this strand than those from the other strands.</p> <p>Students were successful on questions comparing linear and non-linear relations.</p> <p>Students struggled with the question requiring them to determine the equation of a line.</p>	<p>Provide students with many opportunities to create and interpret graphs. Include and emphasize scales that do not have a one-to-one correspondence, especially with respect to calculating slope.</p> <p>Continue to have students make connections among the different representations of linear relationships (e.g., graphs, equations, tables of values).</p>
Measurement and Geometry	<p>Students performed well on measurement and geometry questions requiring specific knowledge about the Pythagorean theorem, angles and angle relationships.</p> <p>Students were not as successful on multi-step questions of both types (multiple-choice and open-response).</p> <p>Scorers observed that a lack of attention to detail (e.g., diameter versus radius) contributed to reduced success on open-response questions.</p> <p>Scorers observed that students who were successful on open-response questions provided justification for each step of their solution process. For example, on geometry questions, they recorded calculated angle measures in the angles on the diagram.</p>	<p>Require students to provide complete justifications for their answers. Model and emphasize working backward with the answer as a strategy to verify its reasonableness.</p> <p>Instruct students on how to choose important words from the question to determine what the question requires and how to make a plan for solving it.</p> <p>Review instructional timelines to ensure that measurement and geometry expectations receive sufficient instructional time.</p>
General Observations on the Mathematics Data	<p>Similar to last year, students had difficulty solving multi-step problems.</p> <p>Students continued to misinterpret important details in questions for all strands.</p>	<p>Continue to provide students with multi-step problems in various contexts across all strands. Model problem-solving processes for students, and provide opportunities for students to demonstrate and discuss problem-solving strategies.</p> <p>Require students to verify their answer by re-stating what the problem requires and considering the reasonableness of their answer.</p> <p>Model working backward to verify a solution.</p> <p>Continue to support students by using Universal Design for Learning.</p>

Applied Course	Observations:	Strategies for Improvement:
Gender	Male students performed better than female students on questions involving linear relations in context.	Continue to provide opportunities for mixed-gender group work. Rotate roles in the groups to give all members opportunities to experience leadership.
English Language Learners	<p>English language learners were more successful on questions without a context than on those with a context.</p> <p>Overall, English language learners exhibited a pattern of relative strengths and weaknesses similar to that of the general population.</p>	Continue to provide multiple opportunities for English language learners to solve contextualized problems using a variety of tools, such as manipulatives (concrete materials) and graphic organizers . Support students by providing exemplars at various levels of performance.
Students with Special Education Needs (Excluding Gifted)	<p>Students with special education needs continue to perform at a slightly lower level than the general population.</p> <p>Overall, students with special education needs exhibited a pattern of relative strengths and weaknesses similar to that of the general population.</p>	<p>Continue to differentiate instruction for all students but particularly for those with special education needs. Review the <i>Guide for Accommodations</i> and each student's Individual Education Plan to ensure the accommodations that the student receives are permitted for the assessment and are supports he or she uses regularly.</p> <p>Encourage students who are eligible to receive accommodations to take advantage of them.</p>

Conceptual understanding: Go to page 74 of *Education for All: The Report of the Expert Panel on Literacy and Numeracy Instruction for Students with Special Education Needs, Kindergarten to Grade 6* for a brief discussion of the link between procedural knowledge and conceptual understanding at <http://www.edu.gov.on.ca/eng/document/reports/speced/panel/speced.pdf>

Differentiated instruction: Go to

- pages 23 and 36–47 of *Targeted Implementation and Planning Supports for Revised Mathematics (TIPS4RM), Grades 7, 8, 9 Applied and 10 Applied: Developing Mathematical Literacy* for outlines of differentiation based on various student and learning factors at <http://www.edu.gov.on.ca/eng/studentsuccess/lms/files/tips4rm/TIPS4RMDevMathLit.pdf>
- “Professional Learning Guide: Differentiated Instruction” for what differentiated instruction means in the classroom and considerations relating to its implementation at <http://www.edu.gov.on.ca/eng/studentsuccess/lms/differentiatedInstruction.pdf>
- pages 14–15 of *Education for All: The Report of the Expert Panel on Literacy and Numeracy Instruction for Students with Special Education Needs, Kindergarten to Grade 6* for an overview at <http://www.edu.gov.on.ca/eng/document/reports/speced/panel/speced.pdf>
- the webcast *Differentiated Instruction: Continuing the Conversation* at <http://www.curriculum.org/secretariat/march29.shtml>
- the webcast *Differentiating Mathematics Instruction* at <http://www.curriculum.org/secretariat/may28.shtml>

English language learners: Go to

- *TIPS for English Language Learners in Mathematics, Grades 7, 8, 9 Applied and 10 Applied: Developing Mathematical Literacy for All* for support for teachers of English language learners in Grade 9 applied courses at <http://www.edu.gov.on.ca/eng/studentsuccess/lms/files/ELLMath4All.pdf>
- *Many Roots, Many Voices: Supporting English Language Learners in Every Classroom: A Practical Guide for Ontario Educators* for insights on ways to assist English language learners at <http://www.edu.gov.on.ca/eng/document/manyroots/manyroots.pdf>

Exemplars: Go to

- *The Ontario Curriculum Exemplars, Grade 9* at <http://www.edu.gov.on.ca/eng/curriculum/secondary/math9ex/>
- EQAO's sample assessment questions, which include scoring guides, item-specific rubrics and sample student responses at <http://www.eqao.com/Educators/Secondary/09/09.aspx?Lang=E&gr=09&Aud=Educators&App=Educators>

Graphic organizers: Go to

- page 25 of *Targeted Implementation and Planning Supports for Revised Mathematics (TIPS4RM), Grades 7, 8, 9 Applied and 10 Applied: Developing Mathematical Literacy* for an overview at <http://www.edu.gov.on.ca/eng/studentsuccess/lms/files/tips4rm/TIPS4RMDevMathLit.pdf>
- “Professional Learning Guide: Graphic Organizers” at <http://www.edu.gov.on.ca/eng/studentsuccess/lms/graphicOrganizers.pdf>
- *Think Literacy: Cross-Curricular Approaches, Grades 7–12: Mathematics, Grades 7–9* for examples of graphic organizers at <http://www.edu.gov.on.ca/eng/studentsuccess/thinkliteracy/files/ThinkLitMath.pdf>

Manipulatives (concrete materials): Go to

- *Professional Learning Guide: Manipulatives* at <http://www.edu.gov.on.ca/eng/studentsuccess/lms/manipulatives.pdf>
- page 22 of *Targeted Implementation and Planning Supports for Revised Mathematics (TIPS4RM), Grades 7, 8, 9 Applied and 10 Applied: Developing Mathematical Literacy* at <http://www.edu.gov.on.ca/eng/studentsuccess/lms/files/tips4rm/TIPS4RMDevMathLit.pdf>

Manipulatives (concrete materials) continued:

- pages 48–50 and 58 of *Leading Math Success: Mathematical Literacy, Grades 7–12: The Report of the Expert Panel on Student Success in Ontario* for a list of essential manipulatives at <http://www.edu.gov.on.ca/eng/document/reports/numeracy/numeracyreport.pdf>
- the PowerPoint presentation *Family and Community Connections: Manipulatives and Technology* for examples of the use of manipulatives at <http://www.edu.gov.on.ca/eng/studentsuccess/lms/library.html#family>

Model: Go to pages 63–64 of *Education for All: The Report of the Expert Panel on Literacy and Numeracy Instruction for Students with Special Education Needs, Kindergarten to Grade 6* for suggestions on modelling at <http://www.edu.gov.on.ca/eng/document/reports/speced/panel/speced.pdf>

Problem-solving strategies: Go to

- page 2 of *Targeted Implementation and Planning Supports for Revised Mathematics (TIPS4RM): Mathematical Processes* at <http://www.edu.gov.on.ca/eng/studentsuccess/lms/files/tips4rm/TIPS4RMProcesses.pdf>
- pages 12–13 of *TIPS: Mathematics 2* for information about the role of students and teachers in selecting and applying a problem-solving strategy at <http://www.curriculum.org/csc/library/tips/section2/ccmathprocess.pdf>
- pages 38–44 of *A Guide to Effective Instruction in Mathematics, Kindergarten to Grade 6: Volume Two, Problem Solving and Communication* at http://www.eworkshop.on.ca/edu/resources/guides/Guide_Math_K_6_Volume_2.pdf

Reading and writing strategies: Go to *Think Literacy: Cross-Curricular Approaches, Grades 7–12: Mathematics, Grades 7–9* at <http://www.edu.gov.on.ca/eng/studentsuccess/thinkliteracy/files/ThinkLitMath.pdf>

Students with special education needs: Go to

- the numeracy segments of the webcast *High-Yield Strategies to Improve Student Learning* at <http://www.curriculum.org/secretariat/may2.shtml>
- *Education for All: The Report of the Expert Panel on Literacy and Numeracy Instruction for Students with Special Education Needs, Kindergarten to Grade 6* at <http://www.edu.gov.on.ca/eng/document/reports/speced/panel/speced.pdf>

Universal Design for Learning (UDL): Go to

- pages 10–13 of *Education for All: The Report of the Expert Panel on Literacy and Numeracy Instruction for Students with Special Education Needs, Kindergarten to Grade 6* at <http://www.edu.gov.on.ca/eng/document/reports/speced/panel/speced.pdf>

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